

Appendix C Structure Removal Examples and Challenges

Red Bluff Diversion Dam Fish Passage Improvement – Tehama County

Red Bluff Diversion Dam is on the Sacramento River immediately downstream of Red Bluff. When the dam's gates are lowered into the Sacramento River, the water behind the 41-foot-high and 752-foot-wide dam is raised, creating Lake Red Bluff and allowing gravity diversion into the Tehama-Colusa and Corning canals for delivery to 17 irrigation districts. With the gates in place, the dam presents an upstream and downstream obstacle to migrating fish. Fish ladders are inefficient at certain flows. Additionally, the tailrace and lake created by the dam provide habitat for species that prey on juvenile salmon, reducing their survival rates. Fish passage at the dam is crucial because a substantial number of Chinook salmon in the Sacramento River naturally spawn in the reach upstream of the dam.

In 1995 a large research pumping plant was installed. The pumps take fish and water at the same time but screen the fish out after pumping. Testing of the pumps concluded in 2001, and results are being reviewed to determine if such technology could be used in place of the diversion dam or elsewhere. Capital and research costs were about \$25 million.

In addition, the Tehama-Colusa Canal Authority (TCCA)—with Central Valley Project Improvement Act (CVPIA) and California Proposition 204 funds—and the US Bureau of Reclamation (USBR) are jointly funding the Fish Passage Improvement Project at the dam. The project is seeking alternative diversions to reduce the impacts of the dam on upstream and downstream migration of juvenile and adult anadromous fish, while improving the reliability of agricultural water supply to the Tehama-Colusa and Corning Canal systems. Three alternatives include (1) dam improvements and construction of new fish ladders, (2) fish screens and pumps, or (3) year-round “gates-out” with water diverted by pumps and screened intakes. Recreation at the lake is important to Red Bluff and the surrounding community, so alternatives that affect the lake must be carefully weighed.

The project is in Phase II, Preliminary Design and Environmental Documentation. A record of decision is expected by April 2003. Once the ROD is completed, future phases will include Phase III, Final Design and Permit Coordination; Phase IV, Construction; and Phase V, Monitoring, which will be conducted for 7 to 10 years thereafter.

Cooperating agencies, organizations, and others include TCCA, USBR, city of Red Bluff, Tehama County, Red Bluff Chamber of Commerce, Farm Bureau, fishing and environmental interests, educational groups, US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Game (DFG), and the California Department of Water Resources (DWR).



Photo C-1 Sacramento River—Red Bluff Diversion Dam/USBR photo

For more information, go to Web site or contact staff listed below:
<http://www.tccafishpassage.org/>

Mike Urkov, project planner,
CH2M Hill.
(530) 229-3238; e-mail:
murkov@ch2m.com

Harry Rectenwald, DFG,
(530) 225-2368; e-mail:
hrectenw@dfg.ca.gov

Art Bullock, TCCA.
(530) 934-2125. e-mail:
tcwaterman@aol.com

Max Stodolski, USBR.
(530) 529-3890. e-mail:
mstodolski@mp.usbr.gov

Diversion Dams, Butte Creek – Butte County

Numerous restoration projects on Butte Creek are completed or are under way. The creek is one of four Sacramento River tributaries that support populations of Central Valley spring-run Chinook salmon. The Western Canal Water District's (WCWD) Butte Creek Fish Passage Improvement Project involved five dams: Point Four Dam, Western Canal Main Dam, Western Canal East Channel Dam, McGowan Dam, and McPherrin Dam. The dams ranged from 6- to 12-feet high and 10- to 100-feet wide.

Project objectives were to eliminate 12 unscreened diversions that impacted juvenile salmonids, to reconfigure water delivery facilities to make them fish-safe, to restore spawning and rearing habitat for threatened spring-run Chinook salmon, and to increase water supply reliability for agriculture and in wildlife refuges. The project also faced the challenges of working within the allowable construction windows to avoid or minimize impacts to salmonids, avoiding interruption of water deliveries during construction, determining how to dewater the construction sites, and overcoming logistical difficulties associated with the distance between construction sites. The project covered 60 square miles.

Completed in the early 1900s, the Western Canal Main and Western Canal East Channel Dams allowed WCWD's Main Canal to cross Butte Creek. Western Canal Main Dam also diverted Butte Creek water for agriculture. Both dams had fish ladders, but they were antiquated. Western Canal Main, Western Canal East Channel, McGowan, and McPherrin dams were removed in 1998 at a cost of \$9.5 million. Point Four Dam was removed in 1993 at a cost of \$365,000. Funding sources included the Anadromous Fish Restoration Program (Central Valley Project Improvement Act), the Ecosystem Restoration Program (CALFED Bay-Delta Program Category III), Four Pumps Mitigation Fund, WCWD, and California Urban Water Agencies. The project removed barriers and modified water diversion and conveyance facilities to restore 25 miles of Butte Creek to unimpeded flow for the first time since the 1920s. This was done while maintaining full water deliveries.

Additional Butte Creek fish passage improvement projects built or replaced defunct fish ladders at other dams, including:

- Parrott-Phelan Fish Screen and Fish Ladder Project (1994)
- Durham Mutual Fish Ladder and Fish Screen Project (1996)
- Rancho Esquon Partners Fish Ladder and Fish Screen Project (1996)
- Gorrill Ranch Fish Ladder and Fish Screen Project (1996).

Benefits of the restoration work have already been seen. The number of adult spring-run spawners increased from 14 in 1987 to 20,000 in 1998.

Centerville and Butte Creek head dams (PG&E hydropower dams upstream of the Butte Creek restoration project) have been considered for removal or modification, but there are unresolved issues about modification of downstream natural barriers and concerns about restrictions on land-use



**Photo C-2 Butte Creek—
Western Canal Dam before
removal**



**Photo C-3 Butte Creek—
Western Canal Dam before
during removal**

For more information, contact:

Paul Ward, DFG
(530) 895-5015; e-mail:
ward@dfg2.ca.gov

Olen Zirkle, Ducks Unlimited.
3074 Gold Canal Drive,
Rancho Cordova, CA 95670
(916) 852-2000; e-mail:
ozirkle@ducks.org

Kevin Dossey, DWR
(530) 529-7362; e-mail:
dossey@water.ca.gov

For more information about
Butte Sink projects, contact:

Rob Capriola, California
Waterfowl Association,
132-B North Enright Ave.,
Willows, CA 95988
(530) 934-9182; e-mail:
robcap@inreach.com

activities should Endangered Species Act-listed anadromous fish gain access to the upper watershed.

Butte Creek Restoration

Restoration of Butte Creek has begun with several restoration plans with varying objectives. Included are:

- Upper Sacramento River Fisheries and Riparian Habitat Management Plan (SB 1086), January 1989, with the stated goal "... to protect, restore, and enhance the fish and riparian habitat and associated wildlife of the upper Sacramento River" and tributaries.
- Central Valley Salmon and Steelhead Restoration and Enhancement Plan (SB 2261), April 1990, with the stated goals to "(1) restore all depleted salmon and steelhead habitat to a condition capable of sustaining population goals; (2) at least double the natural salmon production by the year 2000; (3) develop an annual steelhead run in the Sacramento River system of 100,000 fish; (4) ensure proper mitigation and compensation of existing projects that have resulted in resource loss or which are continuing to cause resource damage; (5) ensure that future projects either avoid adverse impacts to salmon and steelhead and their habitats or provide compensation where impacts cannot be avoided; and (6) enhance the quality of fishing opportunities for inland sport, ocean sport, and commercial users and maintain populations at levels capable of supporting sustained year-round angling opportunities."
- Restoring Central Valley Streams: A Plan for Action, November 1993, with the stated goal "... to restore and protect California's aquatic ecosystems that support fish and wildlife and to protect threatened and endangered species."
- Revised Draft Restoration Plan for the Anadromous Fish Restoration Program (CVPIA AFRP), May 1997, with the stated goal to "... implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991."
- CALFED Bay-Delta Program Ecosystem Restoration Program, July 2000, with the stated goal to "... restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system."

Each of the following actions, listed generally in order of implementation, has been completed or is in progress in the Butte Creek watershed and has been implemented under the general goals and objectives of the above restoration plans.

Parrott-Phelan Diversion

- 1) Name: Parrott-Phelan Fish Screen and Fish Ladder Project.
- 2) Total Project Budget: \$891,591 (Screen: DFG Prop. 70, \$64,500; M&T Chico/Llano Seco Ranches \$64,500) (Ladder: DFG, Wildlife Conservation Board, CVPIA and Four Pumps \$756,591)
- 3) Total Spent to Date: \$891,591
- 4) Stakeholder Groups/Agencies: M&T Chico Ranch, Llano Seco Ranch, USFWS, DFG.

- 5) Project Start Date: 1994
- 6) Project Goals and Objectives: Provide adequate passage for juvenile and adult anadromous fish.
- 7) Current Status: The fish ladder and screen are being operated and maintained by M&T Chico Ranch. Also, each of the structures is being used by resource agencies for technical analysis of structures and biological analyses of life history patterns of anadromous fish. The information generated has and is being used in the development and implementation of structures in other watersheds and to better define life history patterns of anadromous fish throughout their entire migratory range.
- 8) Future Actions: Land acquisition and riparian restoration are being implemented on lands adjacent to the project owned by both the M&T Chico Ranch and DFG.

Parrott-Phelan Diversion

- 1) Name: M&T Pumps Water Exchange
- 2) Total Project Budget: \$4.6 million for pump relocation and screening on Sacramento River. Water exchange was not valued but was M&T Chico/Llano Seco Ranch's contribution to project cost.
- 3) Total Spent to Date: same as above
- 4) Stakeholder Groups/Agencies: M&T Chico and Llano Seco Ranches, DFG, USFWS, USBR, State Water Resources Control Board (SWRCB), Butte County Superior Court (adjudication), DWR.
- 5) Project Start Date: 1996.
- 6) Project Goals and Objectives: Provide adequate flows in Butte Creek for anadromous fish.
- 7) Current Status: Water exchange agreement with USBR is being completed and will eventually result in a SWRCB permanent designation for instream use. Water exchange involves respective ranches leaving 40 cfs in Butte Creek (primarily west branch of Feather River water) from October to June, in exchange for the right to divert equal volume from Sacramento River at M&T Pumps.
- 8) Future Actions: Completion of water right agreements with USBR, SWRCB, Butte County Superior Court (adjudication). Potential additional water acquisitions at the Parrott-Phelan diversion site to provide ultimate minimum base flow.

Western Canal Diversions

- 1) Name: Western Canal Siphon Project
- 2) Total Project Budget: \$9.7 million. (Initial planning: WCWD \$150,000; DFG Tracy Mitigation \$150,000) (Implementation: WCWD, \$3.133 million; CVPIA, \$3.133 million; Cat. III Met., \$3.133 million)
- 3) Total Spent to Date: \$9.7 million
- 4) Stakeholder Groups/Agencies: WCWD, Gorrill Ranch, McGowan Ranch, McPherrin Ranch, USBR, DFG, USFWS, DWR.
- 5) Project Start Date: 1992
- 6) Project Goals and Objectives: Provide adequate fish passage at McPherrin, McGowan, Western Canal (2 dams) by removing respective dams from Butte Creek.
- 7) Current Status: Siphon installation and dam removals were completed during 1998. Butte Creek flows legally diverted at the sites where the

dams were removed have either been dedicated for instream use or moved to the Gorrill Diversion site. The WCWD provided alternate sources of water to all diverters previously utilizing the four structures.

- 8) Future Actions: None

Western Canal Diversion Water Rights

- 1) Name: Western Canal Project Water Rights Acquisition
- 2) Total Project Budget: Included in Western Canal Siphon and Gorrill Diversion Fish Ladder and Fish Screen Projects.
- 3) Total Spent to Date: Same
- 4) Stakeholder Groups/Agencies: WCWD, Gorrill Ranch, Alma Ryan, Jim McAlister, DFG, Butte County Superior Court (adjudication), DWR.
- 5) Project Start Date: 1992 (Part of overall Western Canal Siphon Project)
- 6) Project Goals and Objectives: Provide base instream flows of 10 cfs July through September downstream of the Gorrill Diversion site.
- 7) Current Status: Currently implemented and within the responsibility of the DWR Butte Creek Watermaster.
- 8) Future Actions: None.

Point Four Diversion

- 1) Name: Point Four Dam Removal Project.
- 2) Total Project Budget: \$365,000 (WCWD \$235,000; DFG Prop. 70, \$130,000)
- 3) Total Spent to Date: \$365,000
- 4) Stakeholder Groups/Agencies: Point Four Ranch, WCWD, DFG, DWR.
- 5) Project Start Date: 1991
- 6) Project Goals and Objectives: Provide adequate fish passage at Point Four Dam.
- 7) Current Status: Dam was removed in 1993 and an alternate source of water provided to the diverter via the WCWD.
- 8) Future Actions: Possible relocation of original Butte Creek water right for the benefit of fish and wildlife.

Durham Mutual Diversion

- 1) Name: Durham Mutual Fish Ladder and Fish Screen Project.
- 2) Total Project Budget: \$935,441. (Initial Planning and design: DFG Tracy Mitigation \$66,000) (Implementation: CVPIA, \$464,720; CALFED Cat. III., \$316,500; Four Pumps, \$88,221)
- 3) Total Spent to Date: \$935,441.
- 4) Stakeholder Groups/Agencies: Durham Mutual Water Company, DFG, DWR, TNC, DU.
- 5) Project Start Date: 1996
- 6) Project Goals and Objectives: Provide adequate fish passage at Durham Mutual Diversion Dam.
- 7) Current Status: The fish ladder and screen, which were completed in 1998, are operated and maintained by the Durham Mutual Water Company and are awaiting certification by the Anadromous Fish Screen Program (AFSP) technical team.
- 8) Future Actions: None.

Durham Mutual Dam Water Rights

- 1) Name: Durham Mutual Water Rights Acquisition Project.
- 2) Total Project Budget: Unknown
- 3) Total Spent to Date: Unknown
- 4) Stakeholder Groups/Agencies: Resource Renewal Institute (RRI), Butte County Superior Court (adjudication), SWRCB, Clarence Entler, Mary Roth, Bee Compton, DWR Butte Creek Watermaster.
- 5) Project Start Date: 1997
- 6) Project Goals and Objectives: Provide adequate flows in Butte Creek for anadromous fish
- 7) Current Status: Water rights to first priority Butte Creek flows (5 cfs April-September, 3 cfs October, 1.5 cfs November-March) were acquired by RRI for instream use. RRI is attempting to sell rights to USBR under CVPIA water acquisition program. RRI has filed under the Butte Creek Adjudication for dedication of acquired flows for instream use, and may file with SWRCB for similar dedication.
- 8) Future Actions: Potential acquisition of additional water rights at this site.

Adams Diversion

- 1) Name: Rancho Esquon Partners Fish Ladder and Fish Screen Project.
- 2) Total Project Budget: \$1,108,460. (Initial Planning and design: DFG Tracy Mitigation \$66,000) (Implementation: CVPIA \$520,897; Cat. III Met. \$520,897).
- 3) Total Spent to Date: \$1,108,460.
- 4) Stakeholder Groups/Agencies: Rancho Esquon Partners, DFG, DWR, DU.
- 5) Project Start Date: 1996
- 6) Project Goals and Objectives: Provide adequate fish passage at Adams Diversion.
- 7) Current Status: Project was completed during 1998, with subsequent modifications to the low-flow fish ladder completed in 1999. Technical analysis of performance has been completed and is pending AFSP final certification. Fish ladder and fish screen are being operated and maintained by Rancho Esquon Partners.
- 8) Future Actions: DFG will closely monitor low-flow fish ladder for potential future modifications.

Gorrill Diversion

- 1) Name: Gorrill Ranch Fish Ladder and Fish Screen Project.
- 2) Total Project Budget: \$1,618,563. (Initial Planning and design: DFG Tracy Mitigation \$66,000) (Implementation: CVPIA \$755,949; Cat. III Met/Prop. 204 \$705,947).
- 3) Total Spent to Date: \$1,618,563.
- 4) Stakeholder Groups/Agencies: Gorrill Ranch, DFG, DWR, DU, WCWD.
- 5) Project Start Date: 1996.
- 6) Project Goals and Objectives: Provide adequate fish passage at Gorrill Diversion and consolidate WCWD's remaining Butte Creek water rights.
- 7) Current Status: The project was completed during 1998 and has been certified by AFSP technical team. Fish screen and fish ladders are being operated and maintained by Gorrill Ranch.

- 8) Future Actions: Potential need for flow monitoring station immediately downstream of structure to manage instream flow acquisitions.

Sanborn Slough Bifurcation

- 1) Name: Bifurcation Sanborn Slough Water Control Structure Project.
- 2) Total Project Budget: \$1.07 million. (Initial Planning and design: USFWS AFRP \$70,000) (Implementation: USFWS Sacramento Refuge \$1 million).
- 3) Total Spent to Date: \$1.07 million
- 4) Stakeholder Groups/Agencies: CWA, DU, RD1004, Eric Foracre, Butte Sink Waterfowl Association, USFWS, DWR, DFG.
- 5) Project Start Date: 1998.
- 6) Project Goals and Objectives: Provide adequate fish passage and water control at Sanborn Slough Butte Sink bifurcation.
- 7) Current Status: Standalone subproject was completed as per total spent of \$1.07 million. Management agreement is being developed with primary management responsibility assigned to RD1004, in conjunction with Eric Foracre, and the Butte Sink Waterfowl Association.
- 8) Future Actions: Initial project funding was insufficient to complete as per final design. Additional funding (\$1 million) is currently being sought to complete additional phase of project.

MCAMIS Property Land Acquisition

- 1) Name: Butte Creek Ecological Preserve Honey Run Project.
- 2) Total Project Budget: \$546,067. (CALFED Cat. III \$186,128; NFWF \$132,439; USFWS AFRP \$125,000; WCB \$102,500)
- 3) Total Spent to Date: \$546,067
- 4) Stakeholder Groups/Agencies: CSUC Research Foundation, John McAmis, DFG, USFWS, BCWC.
- 5) Project Start Date: 1997
- 6) Project Goals and Objectives: Protect riparian corridor and aquatic habitat valuable to the restoration and survival of anadromous fish.
- 7) Current Status: The 90-acre McAmis property was acquired in 1998 and is contiguous with the DFG-owned Butte Creek Ecological Preserve Canyon and Virgin Valley Units which extend downstream to Highway 99. The California State University, Chico Research Foundation has completed a memorandum of understanding with DFG to assume management responsibility for entire Butte Creek Ecological Preserve and will use the McAmis (Honey Run Unit) for educational purposes in conjunction with CSUC.
- 8) Future Actions: Additional funding is being sought to initiate the first two years of management activities, after which it is anticipated that endowments funded by local donors and alumni will suffice.

Keeney Property Land Acquisition

- 1) Name: Butte Creek Preserve, Keeney Ranch
- 2) Total Project Budget: \$735,000 (USFWS AFRP)
- 3) Total Spent to Date: \$735,000
- 4) Stakeholder Groups/Agencies: The Center For Natural Lands Management, Butte County Fish and Game Commission, USFWS AFRP, CSUC Research Foundation, Keeney Ranch.
- 5) Project Start Date: 1997
- 6) Project Goals and Objectives: Protect riparian zone for the benefit of anadromous fish and other wildlife.
- 7) Current Status: The 56-acre Keeney property was acquired during 1997. The property is owned and managed by The Center for Natural Lands Management in partnership with the CSUC Foundation.
- 8) Future Actions: Completion of the management plan and riparian restoration is awaiting a permit from the State Reclamation Board. In conjunction with the Butte County Fish and Game Commission, approximately 15 acres will sell as a mitigation bank.

The Question of Structure Removal or Retention

About one-quarter of the 76,000 dams listed in the US Army Corps of Engineers National Inventory of Dams (NID) were constructed during the 1960s; many structures are now a half-century old. By the year 2020, the Association of State Dam Safety Officials estimates, 80 percent of all dams will reach their design life (ASDSO 2001). The downstream hazard of dams, in the event of failure, is considered significant or high for over 30 percent of the dams in the NID database. Consequently, many dams are or will soon be in need of safety rehabilitation.

The costs for dam rehabilitation can sometimes exceed the economic return of a dam. With 75 to 90 percent of dams in private or local government ownership, rehabilitation and continued operation is sometimes financially infeasible.

More than 2,200 dams in the United States are for hydroelectric generation and the Federal Energy Regulatory Commission issues operating licenses for more than 1,000 of these dams (FERC 2002). California, New York, Wisconsin and Maine collectively have more than 36 percent of the hydroelectric dams requiring FERC licenses. By the year 2010, more than a quarter of all FERC-licensed dams will need to be reissued a FERC license. Dam decommissioning is sometimes considered as an alternative during the relicensing process.

American Rivers has documented the removal of almost 500 structures, though the actual total is likely to be many more (Heinz 2002). The nation has many small dams that are abandoned or obsolete and whose owners may wish to consider removal as a viable option. Almost all dams removed were small and privately owned. Reasons for dam removal included economic or structural obsolescence, safety, legal or financial liability, dam site restoration, ecosystem and watershed restoration, riparian and aquatic species

habitat restoration, unregulated flow recreation, and water quality or quantity.

Decision-making approaches about dam retention or removal include (1) establishing goals, objectives, and basis for the decision, (2) identifying major issues of concern, (3) assessing potential physical, biological, and economic and social indicators and outcomes, and (4) making decisions with a framework that encompasses costs and benefits, gains and losses, public support and concerns, and private and public interests. Data collection and assessment of outcomes such as likely future conditions are key components to each of these steps. This approach could be applied to any structure that obstructs fish migration (Heinz 2002; Trout Unlimited 2001).

Key Considerations

Four key areas for consideration in any dam removal or retention project: physical environment, biological changes, economic aspects, and social aspects (Heinz 2002).

Physical Environment

Dam removal can restore some but not all of the physical characteristics of the river that existed before the dam were built, but that the most important positive outcome of dam removal is the reconnection of river reaches so that they can operate as an integrated system again. The extent of biological changes can depend on such things as the size of the dam (storage capacity), quantity and quality of sediment in the reservoir, and stability of the downstream river reach (Heinz 2002).

Biological Changes

Dam removal may increase abundance and diversity of aquatic insects, fish and other populations; may destroy wetlands that existed in the reservoir but result in new wetlands downstream; or result in the replacement of one aquatic community with another by changing the environment from a lentic to lotic system. This may, therefore, create a partly natural and partly artificial population structure depending on species and resulting environmental conditions. The most significant biological benefit of removing a small structure is the increased accessibility of upstream habitat and spawning areas for migratory and anadromous fishes (Heinz 2002).

Economic Aspects

Traditional benefit-cost analysis (avoided costs of dam operation and external costs versus lost beneficial effects of dam operation) does not necessarily apply to dam removals because of the challenge of assigning monetary value for environmental losses or gains. While positives and negatives can be arrayed for various stakeholders, many environmental outcomes are uncertain or difficult to establish in monetary terms and adequately incorporate (Heinz 2002; Trout Unlimited 2001). Methods to quantify environmental benefits and costs have been under evaluation and development by the US Army Corps of Engineers in a recent study, Multi-Objective Approaches to Floodplain Management on a Watershed Basis.

More information on these economic evaluation methods and the study is available at <http://www.ecosystemvaluation.org/> and at <http://www.cop.noaa.gov/>

Social Aspects

Finally, the social context of dam removal decisions is often as important as the environmental and economic contexts. Social outcomes of dam removal include aesthetics of the dam site, changed recreational opportunities, or loss of a historically significant structure or water body. Other issues may include property values, tribal rights, water quality, flood control, and maintenance of storage capability.

Dam removal decisions require careful planning and review. A removal project needs to be scientifically based taking into consideration specific economic and social contexts in planning process that are systematic, open and inclusive of the people in the affected communities.

References Used

- [ABDSO] Association of State Dam Safety Officials. 2001. Top issues facing the dam safety community. <http://www.damsafety.org>.
- [FERC] Federal Energy Regulatory Commission. 2002. Hydropower-water power-use and regulation of a renewable resource. <http://www.ferc.gov/>
- [FOR] Friends of the River. 2000. Rivers reborn: removing dams and restoring rivers in California. <<http://www.friendsoftheriver.org/Publications.html>> (16 Oct. 2000)
- Heinz Center, The. 2002. Dam Removal Science and Decision Making. The H. John Heinz III Center for Science, Economics and the Environment. Washington, D.C.
- Maclin E, Sicchio M, editors. 1999. Dam removal success stories: restoring rivers through selective removal of dams that don't make sense. American Rivers, Friends of the Earth, and Trout Unlimited, Inc. 114 p + appendices.
- National Marine Fisheries Service. 2001. Guidelines for salmonid passage at stream crossings. Final draft. September, 2001. Southwest Region.
- National Marine Fisheries Service. 2002. Improving stream crossings for fish passage. Draft Final Report. Prepared by Humboldt State University Foundation. NMFS contract No. 50ABNF800082. In preparation.
- Trout Unlimited. 2001. Small dam removal. A review of potential economic benefits. Arlington, VA.